Assessment

Forest Plan Revision

Final Climate Report

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for:
Custer Gallatin National Forest

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Contents

Overview

A draft of this report was released for public review on November 30, 2016 and feedback was requested by January 6, 2017. Editorial clarification was added to the final report based on public feedback.

Historical and projected climate, as well as best available science on climate change and climate change impacts, were recently summarized and peer reviewed and provide the primary basis for evaluating climate change impacts for the landscapes encompassed by the Custer Gallatin National Forest (Northern Region Adaptation Partnership (NRAP); Halofsky et al. 2016). This effort was part of a broader evaluation of resource vulnerability on Forest Service Northern Region national forests and adjacent jurisdictions. Portions of the Custer Gallatin within the Middle Rockies ecoregion were included in the Greater Yellowstone subregion portion of the NRAP analysis area, whereas portions of the national forest that fall within the Northwestern Great Plains ecoregion were part of NRAP's Grasslands subregion. The Custer Gallatin National Forest Assessment often refers to the "montane" and "pine savanna" regions of the national forest. The montane region is part of NRAP's Greater Yellowstone subregion. The pine savanna region is part of NRAP's Grasslands subregion.

Mean air temperatures have increased for both areas of the Custer Gallatin since 1895, and are projected to continue to increase for the foreseeable future (Halofsky et al. 2016). However, the greater topographic relief and variability of the montane portion (slope, aspect, elevation) of the national forest means that these temperature increases will also manifest themselves differently even in adjacent watersheds. Conversely, even though the pine savanna portion of the national forest is somewhat higher than surrounding landscapes and has topographic variability, it varies much less than on the montane portion. Thus, the effects of temperature increases are expected to apply much more evenly across the pine savanna landscape than the montane.

Precipitation changes are less certain than temperature changes across the Custer Gallatin. However, slight increases are projected for the montane units, with decreases likely for the pine savanna units, becoming more pronounced progressing from east to west (Halofsky et al. 2016). The increases are projected to occur in the fall, winter, and spring, with reduced precipitation in the summer. However, the predominate form of precipitation is projected to change, with some areas moving from snow to transitional (a mix of snow and rain), or from transitional to rainfall predominating. These kinds of changes may impact stream base flows, if less water is stored as snowpack, as well as the timing of peak flows. Also, some areas may become less suitable (or at least predictable) for winter recreation, like skiing, ice climbing, and so forth.

General consequences of projected climate change impacts are briefly summarized here, with more detail (resource specific observations, projections, consequences, and potential management strategies) provided in each resource report. The consequences of the summarized patterns of temperature and precipitation are lower base stream flows and shifts in vegetation phenology and composition across the Custer Gallatin National Forest. Drought frequency is expected to increase, and precipitation events are anticipated to be more intense. Likewise, fire frequency and severity are also anticipated to increase, as result of both increased temperature and decreased summer precipitation. Such changes may require changed expectations for Custer Gallatin outputs (such as grazing, timber production, restoration of species), infrastructure (such as culvert and bridge sizing, campground locations), and public experiences (such as scenery), although the national forest may play a large role in maintaining many resources because of increased demand or loss elsewhere (Schafer et al. 2014, Halofsky et al. 2016). For example, rising temperatures have already increased demand for water and energy, the rate and extent of landscape fragmentation, and competition between human and ecological needs, a pattern expected to continue in foreseeable climate scenarios (Schafer et al. 2014). Thus, as a public resource, demand may increase for the Custer Gallatin to provide ecological refugia as habitats are lost elsewhere.

Montane Units

The montane portion of the Custer Gallatin is at the boundary of warm, wet maritime flows from the Pacific Ocean and the cooler, drier airflows from Canada, with both therefore influencing climate and weather (Halofsky et al. 2016). This portion of the Custer Gallatin is historically the coolest portion of the Northern Region of the Forest Service, is projected to remain so in the future, and will likely therefore be a refugia for some species for which the majority of the region may become unsuitable. Minimum monthly temperatures for montane portions of the national forest have increased by almost 3 degrees Fahrenheit since 1895. Maximum monthly temperatures have increased by just over 1 degree in the same timeframe. By 2050, both minimum and maximum mean annual monthly temperatures are projected to increase by over an additional 4 degrees Fahrenheit. In addition, average winter maximum temperatures are likely to rise above freezing by 2050 as well. By 2100, temperature is projected to increase 5-10 degrees Fahrenheit for the annual mean monthly minimum, and 7-12 degrees Fahrenheit for the annual mean monthly maximum.

Pine Savanna Units

The pine savanna portion of the Custer Gallatin is primarily influenced by cooler, drier airflows from Canada (Halofsky et al. 2016). This portion of the Custer Gallatin National Forest is the warmest area of the Northern Region of the Forest Service, and will remain so into the future. Minimum monthly temperatures have increased by 2.5 degrees Fahrenheit since 1905, and maximum monthly temperatures by more than 1 degree. By 2050, both minimum and maximum mean annual monthly temperatures are projected to increase by about 4 degrees Fahrenheit. In addition, average winter maximum temperatures are likely to rise above freezing by 2050 as well. By 2100, temperature is projected to increase by 5-11 degrees Fahrenheit for the annual mean monthly minimum, and 6-10 degrees Fahrenheit for the annual monthly maximum. Although slight increases in precipitation are projected for the NRAP Grasslands portion of the Northwestern Great Plains overall, the western portions encompassed by the Custer Gallatin National Forest are expected to actually be drier than at present. Even if precipitation remains static, summer drying and drought is still likely due to the combination of increased temperatures and evapotranspiration. Overall, the magnitude of expected changes exceeds those experienced in the past, and exceeds existing societal planning efforts to adapt to the impacts of likely scenarios (Shafer et al. 2014).

Key Findings

- Both minimum and maximum monthly temperatures have already risen over the past century and are projected to continue to increase by as much as 12 degrees Fahrenheit by 2100.
- Precipitation changes are less certain than temperature changes across the Custer Gallatin National Forest.
- Expected consequences include lower base stream flows, shifts in vegetation phenology and composition, increased drought frequency, more intense precipitation events, and increased fire frequency and severity.
- These anticipated changes may affect Custer Gallatin outputs (such as grazing, timber production, restoration of species), infrastructure (such as culvert and bridge sizing, campground locations), and public experiences (such as scenery).

References

Halofsky, Jessica E.; Peterson, David L.; Dante-Wood, S. Karen; Hoang, Linh; Ho, Joanne J.; Joyce, Linda A., editors. 2017. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. (in press)

Shafer, M., D. Ojima, J. M. Antle, D. Kluck, R. A. McPherson, S. Petersen, B. Scanlon, and K. Sherman. 2014: Ch. 19: Great Plains. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Mellilo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 441-461. Doi:10.7930/J0D798BC. Http://nca2014.globalchange.gov/report/regions/great-plains